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ABSTRACT

In the last 10 years, an approach to electronic distance education called audiographic computerized telelearning using standard telephone lines has come to the fore. Telelearning is a cost-effective system which optimizes existing computer facilities and creates a teaching-learning environment that is interactive, efficient, and adaptable to a wide range of subject matter. Prospective teachers can easily be trained in the technology and will be able to readily adapt their teaching style to the medium. This paper describes salient characteristics of audiographic telelearning systems (including both equipment and organizational requirements); selected institutional experiences (including a joint venture involving Harvard University, Boston University, and Beijing University to teach mathematics and biomedicine and current programs at Louisiana State University); research findings on the efficiency and effectiveness of the system in supporting learning; and the potential of the system in extension education, with particular emphasis on home economics education in the Louisiana Cooperative Extension Service. The results of a participant evaluation of the home economics telelearning program are presented in tabular form. (7 references) (GL)

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POTENTIAL OF AUDIOGRAPHIC COMPUTERIZED TELELEARNING FOR DISTANCE EXTENSION EDUCATION

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POTENTIAL OF AUDIOGRAPHIC COMPUTERIZED TELELEARNING
FOR DISTANCE EXTENSION EDUCATION

Distance Education

Distance education describes teaching-learning relationships in which the participants are geographically separated and communication between them is through such media as radio and television programs, audio and visual recordings, personal computer, teleconference, and correspondence texts. Typically, the learner is given the capacity to interact with the teacher or program directly, and given the opportunity to meet with the teacher on a periodic basis.

Distance education can bring educational opportunities to people who are geographically and financially disadvantaged, the physically handicapped, and those who wish to avoid particular learning dynamics or content, and protect their cultural lifestyle and mobility.

Major reasons cited for using distance education are to provide equity of educational opportunity, and to make up for the lack of conventional resources.

Audiographic Computerized Telelearning

In the last ten years, an approach to electronic distance education called audiographic computerized telelearning using standard telephone lines has come to the fore. It is much less costly to install, maintain and operate than the sophisticated one-way and two-way interactive video systems which require satellite communication and production facilities. It is obviously superior to the more rudimentary audio communication with one- or two-way radio or telephone, because it has both audio and graphics capabilities.

For the sake of convenience, the term "telelearning" will be used in this paper to refer to the audiographic computerized telelearning system. The paper will describe salient characteristics of the system, selected institutional experiences, research findings, and potential of the system to distance extension education.

Characteristics of Telelearning

Equipment. Essential operating equipment for a learning site consists of:

1. IBM personal computer XT or AT (or compatible)
2. Television monitor
3. Teleconference package
4. Speaker system

A scanner is needed to produce visuals from text and graphics, and a video camera to photograph slides or actual specimens.

The television monitor replaces the computer monitor for both production and presentation. A 19-inch or 25-inch color monitor is suitable. The size selected will depend on anticipated audience (class) size. The monitor is connected to the computer and should be capable of taking RGB input.

The teleconference package is commercially marketed by Optel Communications, Inc. It is called "Telewriter III". It is an audiographic, real-time, tablet-based, interactive writing system. The package contains a special modem which transmits both voice and data. The teacher is able to talk to students, and, at the same time, type to the computer screen (television monitor), draw graphics on the electronic pen-tablet, or present previously prepared visuals.

The speaker system is a standard portable teleconference station equipped with a speaker and four microphones.

Organization for Telelearning. Multiple sites in a presentation are linked by telephone. With just two sites, dial-up telephone lines are adequate. For three or more sites, a commercial bridge is used. Both voice and graphics are transmitted over a single telephone line. No time is lost since the two streams (voice and data) can function simultaneously. Furthermore, the system is fully interactive; concurrent two-way communication is possible among all sites. The electronic graphics pad can be used as an electronic chalkboard during presentations. Graphics can be stored on diskettes, and called up for display on the monitor just like a prepared set of overhead transparencies. With appropriate software, data can be imported from other software packages such as spreadsheets to develop a variety of graphic displays. Available graphics packages also permit the capture and use of still-frame video images by the computer, similar to the use of a slide projector. It is also possible to use a scanner to scan images from books, graphic material, etc. and grab the image into the telewriter program. The fidelity and quality of scanned images can be preserved to almost the original through a computer program developed specifically for this purpose[1].

All graphics can be used in real-time or prepared in advance and stored on diskettes for presentation at a later date. Generally, in order to minimize data transmission time, graphics are prepared in advance, stored on floppy disks, and distributed either on diskettes or by modem to each remote site in advance of a presentation. This enables the teacher to quickly call up the desired graphics screens during a presentation. Other appropriate data or graphics can be entered into the computer from the keyboard or graphics pad and simulataneously transmitted to each site during the presentation. Likewise, learners at each remote site can enter

and transmit data to the teacher as well as other sites during the presentation.

Institutional Experiences

Harvard University and Boston University pioneered in using the OPTEL system for distance education in 1984 by teaching calculus in four area high schools. In the fall of 1987 these universities used the system to link up with Beijing University, China, for programs highlighting the latest developments in mathematics and biomedicine.

Louisiana State University is now the leading higher education institution in the United States in the use of this technology to teach classes to students in remote areas of the state. The first telelearning class (Social Work 5101, Maladaptive Processes) was taught during the fall semester of 1985 from the main campus in Baton Rouge to eight students at the LSU-Alexandria campus, 125 miles away. Since then, 31 telelearning classes have been taught with a total enrollment of 637 students. A variety of courses in Economics, Education, Communication Disorders, Library Science, Management, Marine Science, Special Education, and Vocational Education have been taught.

Learning sites, in addition to the Baton Rouge campus, have been established by the university in eight strategic locations to get statewide coverage. Maximum distance from any of these sites for a potential audience is about 50 miles. Five sites are managed by the LSU Division of Continuing Education and three have been set up by the Louisiana Cooperative Extension Service. In addition, the state's vocational-technical system has established three sites (expanding to 10 in 1989-90) for its training programs, and there is a high school network consisting of fourteen sites for reaching remote schools with enrichment programs. Potentially, therefore, educational programs can be made available to remote geographic locations in the state.

Telelearning Research

Because of the newness of the system, research on telelearning is limited. But the research supports the learning efficiency and effectiveness of the system, while raising interesting teaching-learning questions.

Maxcy and Maxcy[2] and Shaeffer and Roe[3] found that students rated telelearning significantly higher than classroom instruction in terms of overall impression, instructor pacing, organization and student participation. McMurry, Trott, Garrett and Lavigne[4] corroborated these findings. In addition, a majority of students in their vo-tech classes indicated that lack of the instructor's physical presence did not impede learning, that visuals were effective, and class interaction and cohesion was high.

Research on teleconferencing per se has yielded interesting findings which can be helpful to the design of distance education through telelearning. A few representative studies are reported. In a Kansas study it was found that preference for the system was greater among students who were older, lived in smaller sized communities, had to drive longer distances to learning sites, had previously participated in teleconferencing, and were placed in intermediate sized classes[5]. Davis[6] compared teleconferencing, face-to-face instruction and combinations of the two methods, and found that the all face-to-face group was much more positive toward the method of delivery than were the other three groups - all teleconference, face-to-face prior to teleconference, and teleconference followed by face-to-face. As face-to-face contact increased, the attitude responses of the participants improved. Although there was no significant difference in achievement scores, the all teleconference group obtained the highest score. Recommendations for successful teleconferencing have included humanizing the learning environment allowing for maximum participation by students, implementation of a presentation style which is conducive to learning, and feedback between student and instructor to insure learning.

In a recent study, Maxcy addresses the problem of "community of learning" raised by telelearning, and asks a fundamental question: Is it proper or right to emphasize the linguistic and graphic side of learning to the utter exclusion of visual cuing of the instructor[7]?. Evaluating student and teacher comments about telelearning programs conducted at Louisiana State University, he concludes that the medium transforms the traditional variables in students by-and-large favoring telelearning because it enhances their learning, while instructors express reservations regarding the medium because they miss the classroom interpersonal dimension. Most importantly, he continues, the concept of community shifts from that of a face-to-face transactive teacher-student community to that of an interactive learner community. Telelearning seems to be hitting the mark here. In addition, there is a change in the sense of self emerging in telelearning. Students, in the absence of the teacher, appear to be developing closer personal relationships and a more focused view of the text (the audiographics presentation). Dialogue seems to be replacing didactive teaching. There is also an interesting change in teacher and student risk-taking. Since the students cannot see the instructor, it is difficult to "read" the real dialogical intent of the teacher. The text then becomes the focus without the visual "surround" or horizon of the physical self of the instructor. Students come to risk more with fellow students, thus building a tighter, more intimate student community. Instructors found enormous power over the substantive dimension of instruction. Since they are hidden from students, they can risk less than they might ordinarily in a more typical college classroom. The instructor can present only a minimal self, much like a telephone

solicitor. As one student remarked, "I could not hear you smiling, so I did not know whether to laugh".

Telelearning in the Louisiana Cooperative Extension Service

The Louisiana Cooperative Extension Service (LCES), taking its cue from the successful experience of off-campus class offerings by the Division of Continuing Education, obtained five telelearning units through a grant from the State Board of Regents and committed faculty time and operating funds to pilot test the system from the vantage of the organization and non-formal educational programs. The project was initiated in July 1988 and significant events to date are:

1. September-October 1988: Telelearning demonstrations to administrative staff, research and extension specialists.

2. February-March 1989: Telelearning demonstrations to field staff.

3. February 1989: Telelearning units installed at four sites.

4. March-June 1989: Software development to capture scanned images, and preparation of screens for nutrition/home finance inservice training to home economists.

5. August 23, 1989: Home economists inservice training and evaluation of program.

6. August-September 1989: Survey of counties to determine telelearning program needs for county educational programs.

Evaluation of the home economics inservice telelearning program. One hundred four home economists attended. The respondents rated the presenters' performance, and agreed or disagreed with or were undecided about sixteen positively phrased opinion statements.

Presenters were rated good to excellent by most respondents.

Table 1 gives the distribution of respondents agreeing, disagreeing or being undecided about learning effectiveness, visuals, site arrangements and interaction experienced in the program.

A majority of the respondents agreed that telelearning was more effective than just reading the material, but disagreed that it was better than self-instructional video or a live lecture. Apparently, though, nearly one-half of the respondents did not miss the presenter's physical presence.

Quality and clarity of visuals were appreciated by most respondents. They also agreed that visuals contributed to learning and were well-coordinated with the audio presentation.

Most respondents agreed that interaction generated during the presentation was good.

A comparison of the cost incurred in conducting the telelearning program with seven remote sites versus conducting the program live at these sites is shown below:

Telelearning Program

1.	Long-distance charges @ $30/site/hour for 4 hours	$1350.00
2.	Equipment depreciation (over 1000 presentations)	80.00
3.	Production of visuals (4 mandays)	400.00
	Total	$1830.00

Live program (7 sites)

1.	Travel to 7 sites @ 21c/mile	$ 350.00
2.	Meals and lodging for 3 distant sites (2 spec)	370.00
3.	Salary of 2 specialists for 7 days @ $130/day	1820.00
	Total	$2540.00

In this specific instance, the cost per participant was $18.30 by telelearning, and $25.50 by the conventional method of specialists travelling to the several sites to deliver the program.

Results of telelearning needs survey. Following the successful experience with an inservice training program it was felt that the system could be used in the conduct of programs for extension clientele as well. Therefore, a survey was conducted to determine those topics which county staffs felt could be adapted to the medium in their educational programs. Topics were requested for three audience types - farmers, homemakers and youth. Inservice training topics for agents were also ascertained.

Water Quality ranked highest for all audience types.

For the other audience types, topics requested in order of importance were as follows:

Farmers

Farm financial management (including record keeping)
Pesticides - updates, labelling, disposal, safety
Vegetables - marketing, weeds, insects and diseases, post-harvest
Beef - parasites, electronic sales, winter feeding
Aquaculture as an alternative enterprise and its management

Homemakers

Nutrition - diet analysis, infant and young children, food safety
Clothing - sewing machine selection, serger techniques, new concepts
Housing - insurance, remodeling, interior decoration, finance

Youth

Maintaining record books
Maintaining project books
Leadership - recruitment, management, skill development

Agents

Computer skills
Nutrition - food safety, special diets, food preservation

Potential of Telelearning for Cooperative Extension

Although our experience with telelearning is limited we believe it has teaching potential in a state cooperative extension system. It is obvious that considerations and arrangements of organization and format will be different for non-formal educational programs with extension clientele as compared with formal course offerings with students. Some of these considerations and arrangements, as well as generic aspects, are discussed below:

Technology. The IBM XT or compatible model can only take double density floppy disks. This limits video or slide images to three per disk. A presentation with a number of such visuals would require many disks, which causes interruptions in the presentation for disk changes at the remote sites. This is not a problem with the IBM AT, because it takes high density disks.

Text and graphics can be scanned with a scanner and grabbed into the telewriter package. A computer program has been written by the LCES to convert the scanned image into a television screen picture. There is some loss in image quality, particularly color graphics, but the convenience of this conversion is an offsetting factor.

The size of the monitor will dictate audience size. Generally, a 19-inch monitor is suitable for a group of 15, while a 25-inch monitor is visible to about 25 persons. Larger groups can be accommodated using multiple monitors. However, interaction is sacrificed when the group exceeds 20-25 persons.

Data can be imported from other programs, such as dBase, Lotus, etc. to enhance presentations.

Production. It is important to produce quality images in a presentation. This requires forethought and planning on the part of the presenter and considerable lead production time. It may be necessary to dedicate special resources to production if volume of telelearning programs is high.

Logistics. A number of specific details have to be taken care of to have a successful program. Sites have to be arranged, site coordinators briefed and contacted well in advance of the program, disks and any supplementary educational materials have to be shipped to the sites, the format of the program has to be communicated, seating arrangements for ease of interaction, questioning, class atmosphere, etc. have to be made, and the possibility of combining telelearning with other techniques, such as video presentation at each site, panel/group discussions, have to be explored.

Topics. Telelearning is suitable for a variety of topics that lend themselves to visual representation and discussion.

Teachers. Specialists and agents need to become familiar with the operation of the system so that they can function independently during a presentation. More importantly, since they have to rely on audio communication, they should become skillful in the use of vocal, listening and interactive techniques. Some useful techniques include varying voice pitch and volume, clearly enunciating words, varying the rate of speaking, showing enthusiasm for the subject matter, summarizing, repeating, writing and inviting feedback. Listening techniques include keeping messages short and to the point, placing important concepts early in the presentation, giving participants a listening break every 15-20 minutes, inserting listening cues ("this is important"..."now, remember this"), and paraphrasing difficult questions.

Audience. Deciding the audiences for telelearning programs is critical. It would appear that at the beginning leaders should be the major audience of telelearning. They can multiply the learning effect several fold through their teaching efforts with their constituents. This would enable us to utilize resources more effectively. Later on, we can go directly to farmers and homemakers. With 4-H youth programs which are in the school system, it may be possible to organize telelearning programs for direct teaching.

Economics. The relatively lower cost of the inservice telelearning program was demonstrated. This will vary depending on audience coverage, number of sites, teaching resources involved, etc. Besides this direct saving, there are other economic benefits such as time saved by teachers (specialists) in travelling to multiple sites and using the time saved more productively. Other benefits include avoiding fatigue from travel and the time it takes to recover, the value of subject-matter information being made

available simultaneously to audiences at the different sites. This may be particularly important during an emergency when information timing is critical

Summary

Telelearning offers extension educators an opportunity to extend limited resources to cover a wide distribution of audiences in strategic geographic locations. It is a cost-effective system which optimizes existing computer facilities and creates a teaching-learning environment that is interactive, learning efficient and adaptable to a wide range of subject-matter. Prospective teachers (specialists and agents) can be easily trained in the technology and should readily adapt their teaching style to the medium.

Footnotes

[1] Louisiana Cooperative Extension Service has developed the computer program. Details may be obtained from the author.

[2] Maxcy, Doreen and Spencer J. Maxcy (1986). "Teleconferencing Strategies in Educational Foundations Teaching." Paper presentation, The Southern Futures Society Ninth Annual Conference, Fayetteville, Arkansas.

[3] Shaeffer, J.M. and R.G. Roe (1985). "Effective teaching behaviors as perceived by students in a face-to-face and teleconferencing course" in Parker, L.A. and C.H. Olgren, Teleconferencing and electronic communications IV: Applications, technologies and human factors. Vol. IV. Madison, Wisconsin: Center for Interactive Programs, University of Wisconsin-Extension, 216-222.

[4] McMurry, James G., James W. Trott, Gregory L. Garrett and F. Travis Lavigne, Jr. (1989). "Louisiana's Developing T & I Network." Paper presentation, Southeastern Trade and Industrial Education Conference, New Orleans, Louisiana.

[5] Hilt, Robert S. (1986). Student Perceptions of Selected Demographic and Geographic Variables of the Kansas Telenet System. Ph.D. Dissertation, Kansas State University, Manhattan.

[6] Davis, Delores J. (1984). Evaluation and Comparison of Teleconference Training with Face-to-Face Training and the Effects on Attitude and Learning. Ed.D. Dissertation, Drake University.

[7] Maxcy, Spencer J. (1989). "Computer-Directed Learning and the Problem of Community", International Journal of Instructional Media, 16 (2), 127-135.

TABLE 1

PARTICIPANT OPINIONS OF HOME ECONOMICS TELELEARNING PROGRAM

Opinion Statement	Agree	Undecided	Disagree
<u>General</u>			
Did not miss presenter's presence	47	10	42
Subject matter was suited to telelearning	66	19	16
<u>Learning Effectiveness of Telelearning</u>			
Better than reading the material	58	15	27
Better than self-instructional video	29	29	42
Better than live lecture	19	25	56
<u>Visuals</u>			
Were appealing	70	10	20
Were clear and understandable	76	9	15
Had balance between text and illustrations	76	13	11
Contributed to learning	69	15	16
Visual and audio parts well coordinated	76	9	15
<u>Site Arrangements</u>			
Could see visuals well	74	6	20
Could hear presentation and comments well	78	5	17
<u>Interaction</u>			
Good at my site	83	12	5
Good with other sites	43	35	22
Good with presenter	73	18	9
Should be more interaction and participation by learner	72	17	11